

Two new species of the *Eleutherodactylus rugulosus* group (Amphibia: Anura: Leptodactylidae) from Honduras

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Abstract.—Two new species of *Eleutherodactylus*, *E. pechorum* and *E. olanchano*, of the *E. rugulosus* group are described from Honduras. The following combination of characters will distinguish *E. pechorum* from the remaining *E. rugulosus* group members: male vocal slits present; male nuptial thumb pad absent; finger II < I; female loreal length/eye length ratio ≤ 1.00 ; keels present on unwebbed portions of toes; toes with basal webbing; canthus rounded; posterior surface of thighs marked with numerous pale spots and blotches; anteroventral and posteroventral surfaces of tibial segments barred; ventral surfaces pale yellow; and size moderate. *Eleutherodactylus olanchano* is distinguished from all other *E. rugulosus* group species by the following combination of characters: male vocal slits and nuptial thumb pads absent; finger II > I or II \approx I; tympanum length/eye length ratio ≥ 1.00 ; and male size very small (females unknown).

Recent fieldwork in Honduras has resulted in the discovery of two new species of the *Eleutherodactylus rugulosus* group. One of these species is a streamside dweller, as are most members of the group. However, the other species occurs on forested hillsides, well above streams that are inhabited by *E. aurilegulus*, another *rugulosus* group member. The forest dwelling species represents only the third known member of the *rugulosus* group occurring in that type of habitat (Campbell et al. 1994, Johnson & Savage 1995).

Materials and Methods

All morphological and color pattern traits discussed herein follow the character states and terminology defined by Savage (1975). Comparative data for *E. azueroensis*, *E. taurus*, and *E. vocalis* were taken from Savage (1975). Comparative material examined is listed in Appendix I. The name *rugulosus* is in quotes in this appendix because work in progress by J. A. Campbell and J. M.

Savage will likely severely restrict the geographic distribution of *E. rugulosus*. Thus, the specific identity of the Honduran and Nicaraguan material of *E. "rugulosus"* examined is unresolved at this time. Abbreviations used in each species description are EL (eye length), E–N (anterior border of eye to posterior edge of nostril; equals loreal length of Savage 1975), HL (head length; tip of snout to angle of jaw), HW (greatest width of head), LL (leg length), SL (snout length; anterior border of eye to tip of snout), SVL (snout–vent length), TL (tibia length), and TM (tympanum length). Measurements were made to the nearest 0.1 millimeter under a dissecting microscope. Museum acronyms follow those of Leviton et al. (1985) and color codes are those of Smithe (1975–1981).

Systematics

Eleutherodactylus pechorum, new species
Fig. 1

Holotype.—National Museum of Natural History (USNM) 530000, an adult male,



Fig. 1. Adult male holotype of *Eleutherodactylus pechorum* (USNM 530000), SVL 33.5 mm.

from near a small dam along a small tributary of the Quebrada de Las Marías (15°17.64'N, 85°21.29'W), about 12 airline km NNE La Colonia, Departamento de Olancho, Honduras, 680 m elev., collected 2 Aug 1998 by J. R. McCranie, K. L. Williams, and L. D. Wilson. Original number LDW 11375.

Paratype.—USNM 529999, and adult female with the same locality data as the holotype, except collected 1 Aug 1998.

Referred specimen.—BMNH 1985.1454, an adult female from along the Río Cuyamel, Departamento de Colón, Honduras.

Diagnosis.—The combination of the presence of vocal slits and the absence of nuptial thumb pads in males will distinguish *E. pechorum* from all other described members of the *E. rugulosus* group, except for *E. anciano*, *E. azueroensis*, *E. taurus*, and *E. vocalis*. *Eleutherodactylus pechorum* is distinguished from *E. anciano* by having finger II shorter than finger I (finger II longer than or equal in length to finger I in *E. anciano*), toe keels on toe IV of females (weakly infolded fringes on at least one side of toe IV in all four females), shorter female snouts ($E-N/EL \leq 1.000$ versus

≥ 1.000 , $n = 4$), and larger female size (to 59 mm SVL versus to 41 mm, $n = 4$). In addition, *E. anciano* is known only from remnants of broadleaf cloud forest (Lower Montane Moist Forest formation of Holdridge 1967) at 1770 to 1840 m elevation in southwestern Honduras. The new species differs from *E. azueroensis* of the Península de Azuero, Panama, in having the posterior surface of the thighs marked with numerous pale spots and blotches (a few small pale spots in *E. azueroensis*), the anteroventral and posteroventral surfaces of the tibial segments barred (uniformly brown), the canthus rounded (moderately sharp), and basal toe webbing (moderately webbed; webbing formula II 2–3 1/2 III 3–4 1/3 IV 4 1/3–3 V in *E. pechorum* versus II 2–3 1/4 III 2 2/3–4 IV 4–2 1/2 V in *E. azueroensis*). *Eleutherodactylus pechorum* differs from *E. taurus* of southwestern Costa Rica and adjacent Panama in having toe keels on unwebbed portions of toes (well developed fleshy toe fringes in *E. taurus*), four and one-third segments on toe IV free of webbing (< 4), definite toe discs (barely expanded), and females to 59 mm SVL (females to 80 mm). The new species can be

distinguished from *E. vocalis* of western Mexico by having finger II shorter than finger I (finger II longer than or equal in length to finger I in *E. vocalis*), ventral surfaces pale yellow (white), and the anteroventral and posteroventral surfaces of the tibial segments barred (suffused).

Description of holotype (alcohol after formalin).—An adult male with the following measurements (percentages of SVL in parentheses): SVL 33.5 mm; HL 13.1 mm (39.1); HW 12.5 mm (37.3); EL 3.9 mm (11.6); SL 5.6 mm (16.7); E–N 3.4 mm (10.1); TM 3.5 mm (10.4); LL 56.5 mm (168.7); and TL 19.6 mm (58.5). Dorsum smooth with several enlarged tubercles on upper eyelids, short postorbital ridges also present; snout nearly rounded in dorsal aspect, rounded in profile; canthus rostralis rounded; tympanum prominent; first finger longer than second; finger discs definite, a little over twice width of digit just proximal to discs on fingers III–IV; well developed inner tarsal fold; heels rugose; plantar tubercles absent; inner metatarsal tubercle elongated, elevated, visible from above; outer metatarsal tubercle small, round, barely elevated; toe discs definite, that on toe IV about 1.6 times width of digit just proximal to disc; toes with marginal ridge; toes basally webbed, webbing formula I 2–2 1/2 II 2–3 1/2 III 3–4 1/3 IV 4 1/3–3 V; vomerine tooth patches on elevated, nearly triangular-shaped ridges located postero-medially to ovoid choanae, tooth patches separated by distance less than width of either patch; paired vocal slits present; nuptial pads absent. Belly cream, lightly flecked with dark brown; throat and chest cream, moderately flecked with dark brown; dorsum brown with indistinct dark brown mottling, several white spots scattered on back; postorbital ridges slightly darker brown than adjacent dorsum; dark line absent along canthal ridges; loreal region brown; upper and lower lips with dark brown bars separated by white lines, dark lower lip bars not extending onto chin; top of head brown with slightly paler interorbital bar anterior

to median portion of orbit; supratympanic fold slightly darker brown than adjacent area; groin mottled with dark brown and white; posterior surface of thighs dark brown with numerous cream spots and blotches; anterior surface of thighs pale brown with dark brown vertical bars; underside of thighs and tibial segments cream with very sparse dark brown flecks, barred with dark brown along margins.

Color in life (based on a Kodachrome® slide, except for ventral coloration, which was recorded in life): dorsal surfaces of head and body Verona Brown (223B), with slightly darker brown mottling and slightly paler brown, scattered spots; postorbital ridges mottled Verona Brown (223B) and slightly darker brown; dorsal surfaces of limbs Raw Umber (23), with darker brown crossbands; interorbital region mottled pale brown, medium brown, and dark brown, suggestive of pale interorbital bar outlined with darker brown; dark brown upper lip bars separated by pale brown; tympanum intermediate between Verona Brown (223B) and darker brown mottling; iris coppery brown, reticulated with black; belly and ventral surfaces of thighs pale yellow.

Variation in paratype (alcohol after formalin).—Color is described as follows: belly, chest, and throat cream, lightly flecked with grayish-brown; dorsum grayish-brown with distinct dark brown mottling and elongated, narrow spots; several dirty white small spots also present on lower back; postorbital ridges distinctly darker brown than adjacent dorsum; dark line absent along canthal ridges, although several dark flecks present just anterior to eye; loreal region pale brown; upper and lower lips with medium brown bars separated by dirty white lines, dark lower lip bars not extending onto chin; top of head grayish-brown with slightly paler brown interorbital bar, pale bar bordered anteriorly and posteriorly by dark brown; supratympanic fold darker brown than adjacent area; groin mottled with grayish-brown and pale brown, several dark brown spots also present; posterior

surface of thighs grayish-brown with numerous cream spots and blotches; anterior surface of thighs pale brown with grayish-brown vertical bars; underside of thighs and tibial segments cream, barred with grayish-brown along margins.

The following measurements (percentages of SVL in parentheses) were recorded: SVL 41.2 mm; HL 17.0 mm (41.3); HW 16.0 mm (38.8); LL 70.7 mm (171.6); and TL 24.8 mm (60.2).

Comments on referred specimen.—A single adult female (BMNH 1985.1454; SVL 59.1 mm) from about 50 airline km NNE of the type locality of *E. pechorum* is referred to this species. This specimen is very similar in color pattern and morphology to the female paratype of *E. pechorum*. Also, although the type locality for *E. pechorum* is in the headwaters of the Río Wampú, the locality is only some 15 km from the headwaters of the Río Paulaya. The locality for the BMNH specimen is along a tributary of the latter river. Additionally, *E. epochthidius*, another streamside *Eleutherodactylus* (*E. milesi* group), is known from both the *E. pechorum* type locality and from a locality very near that for BMNH 1985.1454.

Natural history notes.—Both type specimens were collected at night alongside a small stream flowing through nearly pristine forest at 680 m elevation. However, at 660 m elevation, the former forest around this stream has been cleared, as have most of the hillsides surrounding the forest on both sides of the stream. The forest alongside this portion of the stream remains intact only because water from that portion of the stream is piped to several villages below the stream. This extensive deforestation is taking place even though the region is part of the Río Plátano Biosphere Reserve, established as a World Heritage Site in 1980. The type locality is in the Premontane Wet Forest formation of Holdridge (1967).

Etymology.—The name *pechorum* means “belonging to or pertaining to” the Pech, in reference to this frog inhabiting an area

long, but sparsely populated by the indigenous Pech tribe.

Eleutherodactylus olanchano, new species
Fig. 2

Holotype.—National Museum of Natural History (USNM) 529998, an adult male, from a hillside above the Quebrada El Pinol (15°07'N, 86°44'W), Parque Nacional La Muralla, Departamento de Olancho, Honduras, 1200 m elev., collected 14 Aug 1994 by J. R. McCranie and L. D. Wilson. Original number LDW 10319.

Paratypes.—USNM 529991–97, all adult males, all from the type locality, 1180–1200 m elev., collected 21 Jul 1993 (USNM 529996–97) or 12–14 Aug 1994 (the remaining specimens).

Referred specimens.—USNM 529989–90, both adult males, from near Río de Enmedio (14°52'N, 86°48'W), Montaña El Armado, Departamento de Olancho, Honduras, 1350 m elev., collected 13 Jun 1993.

Diagnosis.—The combination of small adult male size (SVL 18.7–29.8, \bar{X} = 24.8; females unknown), large male tympanum (TM/EL 1.00–1.14, \bar{X} = 1.06), finger II longer than or equal in length to finger I, and males lacking vocal slits and nuptial thumb pads will distinguish *E. olanchano* from all other described species of the *E. rugulosus* group. *Eleutherodactylus olanchano* is the smallest known member of the *E. rugulosus* group. Males of all other species reach at least 33 mm SVL (the single known adult males of *E. anciano* and *E. pechorum*), 38 mm SVL (*E. vocalis*), or 40 mm or longer (the remaining *E. rugulosus* group species: Savage 1975, Savage et al. 1988, Campbell et al. 1994, Johnson & Savage 1995).

Description of holotype (alcohol after formalin).—An adult male with the following measurements (percentages of SVL in parentheses): SVL 29.8 mm; HL 13.1 mm (44.0); HW 11.7 mm (39.3); EL 3.5 mm (11.7); SL 4.8 mm (16.1); E–N 3.0 mm (10.1); TM 4.0 mm (13.4); LL 55.6 mm



Fig. 2. Adult male holotype of *Eleutherodactylus olanchano* (USNM 529998), SVL 29.8 mm.

(186.6); and TL 17.6 mm (59.1). Dorsum smooth to weakly granular, with several distinct tubercles on lower back and upper eyelids; postorbital ridges absent; canthus rostralis rounded; tympanum prominent; first finger equal in length to second; finger discs definite, about 1.8 times width of digit just proximal to discs on fingers III–IV; well developed inner tarsal fold; toe discs definite, that on toe IV about 2.0 times width of digit; toes with marginal ridge; toes moderately webbed, webbing formula I 2–2 1/2 II 2–3 1/3 III 3–4 IV 4–2 3/4 V; vocal slits absent; nuptial pads absent. Belly cream, very lightly flecked with dark brown; chest cream, heavily flecked with dark brown; throat heavily flecked with dark brown; dorsum dark brown with several very dark brown markings in postocular region; dark line absent along canthal ridges; loreal region mottled pale and dark brown; upper and lower lips with dark

brown bars separated by cream lines, dark lower lip bars not extending onto chin; top of head pale brown with a few dark brown small spots in interocular region near mid level of orbit; supratympanic fold very dark brown; groin cream, heavily flecked with dark brown; posterior surface of thighs dark brown, with indistinct pale brown blotches; anterior surface of thighs pale brown, with slightly darker, incomplete vertical bars; underside of thighs and tibial segments cream, with very sparse dark brown flecks, barred with dark brown along margins.

Color in life (based on a Kodachrome® slide, except for ventral coloration, which was recorded in life): dorsal surfaces of head and body Cinnamon-Rufous (40), with several dark brown spots in postorbital and interorbital regions and slightly darker brown mottling on lower back; dorsal surfaces of limbs Cinnamon-Rufous (40), with darker brown, somewhat indistinct, cross-

bands; dark brown upper lip bars separated by pale brown; supratympanic folds dark brown; tympanum pale brown; iris reddish-brown, reticulated with dark brown on upper half, grayish-brown, reticulated with dark brown on lower half, both halves not separated by dark band; belly and ventral surfaces of thighs pale yellow.

Variation in type series (alcohol after formalin).—Belly coloration of all paratypes is similar to that of holotype; most specimens have less brown flecking on chest and throat than does holotype; however, one specimen (USNM 529992) has throat and chest more intensely punctated with dark brown; dorsal surfaces of head and body vary from grayish-brown to dark brown, with varying amounts of dark brown spots or lines present in postorbital and interocular regions, these dark marks indistinct in darker specimens; one specimen (USNM 529992) has a rather broad, pale brown middorsal stripe extending from tip of snout to just above vent; most specimens have indistinct pale brown blotches on posterior surface of thighs; however, these blotches can be rather distinct in a few specimens (e.g., USNM 529991–92); underside of thigh and tibial segments similar to that of holotype in all specimens, except that one specimen (USNM 529992) has slightly more flecking medially on thighs near knees than does the holotype.

Morphological measurements of the entire type series include SVL given in millimeters and other measurements as percentages of SVL, range followed by mean in parentheses: SVL 18.7–29.8 (24.8); HL 40.3–44.6 (43.5); HW 37.1–40.1 (38.6); LL 168.8–208.6 (191.0); and TL 56.4–62.9 (59.4). Additionally TM/EL ranges and means are 1.00–1.14 (1.06) in the entire type series, and finger II varies from being longer than finger I to being equal in length to finger I. Examination of the testes of two specimens (USNM 529993–94; 28.1 and 23.1 mm SVL, respectively) confirmed that they are adults.

Comments on referred specimens.—Two

adult males (USNM 529989–90; 26.5 and 24.0 mm SVL, respectively) from about 30 airline km SSW of the type locality agree in all diagnostic features with those of the type series. These specimens were collected by M. R. Espinal. His collection from the Río de Enmedio region also contains two adult females of *E. aurilegulus* (USNM 529987–88; 53.5 and 53.6 mm SVL, respectively). Espinal did not record any habitat information for this collection, but it seems likely that the *E. olanchano* were taken from forested hillsides above the streamside locality where *E. aurilegulus* would be expected to occur.

Natural history notes.—The type series was collected both during the day and at night while active among leaves on the forest floor on a single hillside above the Quebrada El Pinol. Specimens were collected in July and August. Two species of streamside *Eleutherodactylus* (*E. aurilegulus* and *E. stadelmani*; *E. rugulosus* and *E. milesi* groups, respectively) were common alongside the Quebrada El Pinol at the base of the hillside, while *E. lauraster* (*E. rhodopis* group) was found in the same habitat as the *E. olanchano*. This locality is in the Premontane Wet Forest formation of Holdridge (1967), as is the locality for the referred specimens. The known elevational range for this species is 1180 to 1350 m.

Etymology.—The name *olanchano* is Spanish, meaning “native of Olancho,” and is used in reference to this Honduran department, in which this species is apparently endemic. The name is a noun used in apposition to the generic name.

Discussion

Members of the *Eleutherodactylus rugulosus* group occur from southern San Luis Potosí, Mexico on the Atlantic versant and from northern Sinaloa, Mexico on the Pacific versant southward to central Panama (Savage 1975). The two new species described herein appear to have relatively small geographical distributions as do many

other Central American members of this group (Savage, pers. comm.).

Among the described species of the *E. rugulosus* group, *E. pechorum* appears to be most similar morphologically to *E. azueroensis* of low and moderate elevations (60–940 m) of the Península de Azuero, Panama. However, the intervening lowlands (with the exception of the Golfo Dulce area of the Pacific versant of southern Costa Rica and adjacent Panama where *E. taurus* occurs) are inhabited by one or more moderately webbed species of the *E. rugulosus* group in which the males lack vocal slits and nuptial thumb pads. No specimens from the intervening territory resemble either *E. pechorum* or *E. azueroensis* in the subtle features that distinguish species in this group. The localities for *E. pechorum* lie in excess of 900 km NNW of the nearest known locality for *E. azueroensis*.

The second new species described herein (*E. olanchano*) possesses a combination of male characters (very small size, very large tympanum, finger II longer than or equal in length to finger I, and the absence of vocal slits and nuptial thumb pads) not shared with any other described member of the group.

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Appendix I

Comparative material examined

Eleutherodactylus anciano. Honduras—Ocotepeque: El Chagüitón, KU 208999–9001, ROM 18076–80.

Eleutherodactylus aurilegulus. Honduras—Atlántida: Lancetilla, AMNH 54792–96, MCZ 16184–88, 16280, 16284–85, 17448–50, 21270; 2.0 km SE Lancetilla, TCWC 30129; mountains S of Lancetilla, MCZ 16191; 7 km NW Las Mangas, UF 90216; Quebrada La Muralla, SMF 77636–39; Quebrada de Oro, KU 209002–32, 209033 (3), LACM 137286–97; Tela, UMMZ 70329 (7). Colón: Balfate, AMNH 45696–703, 45718; Trujillo, CM 63920–21. Olancho: Quebrada La Calentura, USNM 343704; Quebrada Las Cantinas, USNM 343710–14; between El Díctamo and

Parque Nacional La Muralla Centro de Visitantes, USNM 343625–36; Río de Enmedio, USNM 529987–88; Quebrada La Habana, USNM 343705–09; Quebrada de Las Mesetas, USNM 343695–702; Quebrada del Monte Escondido, USNM 343703; near Parque Nacional La Muralla Centro de Visitantes, USNM 343622–24; Quebrada El Pinol, USNM 343657–94; confluence of quebradas El Pinol and Las Cantinas, USNM 343638–56; near Los Planes, USNM 343637; Quebrada Salitre Lajas, USNM 343715–16; Sendero El Pizote, USNM 343717–19. Yoro: Monte Mataderos, MCZ 21287; Portillo Grande, FMNH 21859–60, 34696–97, MCZ 21273–75, 21289, UMMZ 77852 (3); Santa Marta, FMNH 21857–58, MCZ 21271–72, 21288, UMMZ 77851 (3); Subirana Valley, FMNH 21782, MCZ 21283–86; 6.6 km S Yoro, MVZ 171375–76, USNM 217582–83; ca. 3 km W Yoro, TCWC 23619; ca. 32 km W Yoro, MVZ 175800, USNM 217584–85.

Eleutherodactylus “*rugulosus*.” Honduras—Co-

mayagua: between La Misión and Trincheras, AMNH 54752; Siguatepeque, MCZ 26421. Cortés: Agua Azul, AMNH 54951; Río Guayabal, AMNH 54751; Hacienda Santa Ana, FMNH 4661 (3), 4663, 4665–69, 4691–93, 4695–97, MCZ 17433–34, 21282, SMF 29865; Cañon Santa Ana, FMNH 4671, 4674–75; Lago de Yojoa, MSUM 4540, 4637. El Paraíso: ca. 6 km E Danlí, TCWC 23811; Danlí, BYU 18209; Monserrat, AMNH 54814; Montaña del Volcán, MCZ 26433–35. Francisco Morazán: Agua Amarilla, AMNH 54883; San Francisco, AMNH 54750; Cerro Uyuca, MCZ 26440; Río Yeguaré Valley, MCZ 25954–56, UMMZ 94055 (6); El Zamorano, MCZ 26376–77, 26469. Intibucá: 5 km NE Jesús de Otoro, TCWC 23810. Santa Bárbara: Montaña de Santa Bárbara, AMNH 55309–12. “HONDURAS,” ZMB 13202 (holotype of *Hylodes laevissimus* Werner). Nicaragua—Atlántico Sur: Río Chiquito, SMF 77825. Granada: Volcán Mombacho, SMF 78222–28. Matagalpa: Selva Negra, SMF 78207–21.